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Journal of the Society of Arts.

FRIDAY, OCTOBER 12, 1866.

Announcements by the Council.

Examinations, 1867.

The Programme of Examinations for 1867 is now published, and may be had *gratis* on application to the Secretary of the Society of Arts.

In addition to the prizes offered by the Society of Arts, the Worshipful Company of Coach and Coach Harness Makers offer a prize of £3 in Freehand Drawing, and a prize of £2 in Practical Mechanics, to the candidates who, *being employed in the coach-making trade*, obtain the highest number of marks, with a certificate, in those subjects respectively.

Musical Education Committee.

The Musical Committee resumed its sittings on Wednesday last, and took into consideration the instruction of the Council that the Committee should seek the co-operation of such persons and bodies as may be disposed to aid them in promoting the objects expressed in their two reports already published in the *Journal* (see pp. 565 and 613). The Committee determined, in the first instance, to address themselves to the Members of the Society, and they have directed the Secretary to receive the names of such members as are desirous of co-operating in this important national movement.

It was announced that the Royal Academy of Music, having applied for new premises at Kensington, the Lord President of the Council, the Duke of Buckingham, had requested the Earl of Derby, as President of the Commissioners of the Exhibition of 1851, Earl Granville, as Chairman of the Finance Committee, and the Earl of Wilton, as Chairman of the Directors of the Royal Academy of Music, to act as a Committee for considering this application, and that they had consented to do so.

Proceedings of the Society.

CANTOR LECTURES.

"On the Synthesis and Production of Organic Substances and the Application which some of them Receive in Manufactures." By Dr. F. Crace Calvert, F.R.S., F.C.S., &c.

Lecture II.

Delivered on Friday, April 20th.

On the Transformation of Neutral Substances.

The object in this evening's discourse is to invite you to examine with me the valuable, varied, and curious transformations which one substance is capable of undergoing, and which have been brought out through the study of its chemical nature and composition; and what, I hope, will render these transformations especially attractive is the fact, that they have reference to the reproduction of substances which are either found abundantly in nature, or which have received numerous and useful applications in arts and manufactures. The substance which I refer to is Starch, a white, granulated substance, insoluble in water, which undergoes no change or decay, if kept dry, even for centuries, but which, when damp or brought into contact with water, rapidly undergoes decay. Starch, when boiled for a few minutes with 8 or 10 parts of water, and the whole allowed to cool, forms a jelly, which gives a magnificent blue colour with iodine. This colour has been the subject of much study by chemists, owing to the fact that it disappears when heat is applied to it, and that it reappears as the liquor cools. It is so brilliant that many attempts have been made to apply it in some form or other in arts and manufactures; and in some of my previous lectures I have described some of them. Starch, as you are aware, is most abundantly found in nature, especially in the grains of cereals, such as wheat, barley, oats, &c.; it exists also in large quantities in bulbs, such as potatoes; and in leaves, fruit, stems, and roots. It is easy to conceive that such a substance should have been devised by the Creator, first to preserve and then to feed the young germs contained in seeds, for, as I have just stated, it is unalterable by time if kept in a dry condition, whilst it undergoes the most rapid transformations if placed under certain circumstances, or if it comes in contact with certain chemical agents. Of this we shall have, as we proceed, most interesting instances, especially when we examine the transformations which starch undergoes during the germination of seeds and in the ripening of fruits; but to enable you to understand thoroughly these transformations, allow me to call your attention to some of the transformations which starch undergoes by purely chemical action, and then we shall apply them with better success to the chemical changes which take place in nature under vital action.

When starch is mixed with hot water, and a few thousandths of an acid, especially vitriol, are added, the globules of the starch are swollen; they burst; and the more soluble portions of the amylaceous matter are transformed into what is called soluble starch, the liquor losing its opaque appearance and becoming transparent. I may mention that it is a similar transformation that renders the Glenfield Patent Starch so much appreciated for stiffening net and other similar fabrics, owing to the circumstance that they are stiffened without becoming opaque. Let us now proceed to examine what takes place if the proportion of acid is slightly increased, and the heat continued for a short time; we shall find that the starch is susceptible of undergoing a further molecular change, the liquor assuming a slight yellow tinge, and instead of giving with iodine a bright blue colour it yields a rich crimson, the starch having become converted into what chemists called dextrin. This transformation is purely molecular; nothing is added to or subtracted from the original elements of the starch. But if, instead of stopping the operation at this point, we still continue to boil for, say three or four hours, we shall find that the liquor will gradually cease to yield a colour with iodine, and when it has entirely ceased to do so, if we neutralize the slight acidity of the liquor by adding to it a little chalk, and by filtration remove the gypsum deposit, we shall observe that the liquor has a decided sweet taste, and that we have transformed the starch into glucose, or what is often called grape sugar, because it is found in grapes—fruit sugar, because it is found in most fruits—diabetes sugar, because it is found in diabetes. This interesting transformation of starch into sugar is carried on on the Continent on a most extensive scale, thousands

of tons of glucose being manufactured annually, which are used by brewers as a means of producing a cheap and frothy beer; and allow me to add, "under the rose," that it is also employed—and that not with advantage to the consumer—to adulterate honey. In England glucose is not manufactured, in consequence of the restrictions imposed on it by government and the excise laws, but I must not forget to state that when the transformation of starch into glucose is effected on a commercial scale, the apparatus employed is such as to enable the manufacturer to use a slight pressure, experience having demonstrated that this transformation is much more rapid under the influence of a slight increase of pressure, and therefore the manufacturer avails himself of it. You will remember, no doubt, that in several of my previous lectures I have drawn your attention to the fact, that many chemical transformations are brought about or facilitated by an increase of pressure, easily obtained when the mass acted upon is confined in vessels so constructed as to prevent the vapours from escaping.

The transformation of starch into dextrin is also effected by other means. Thus if it is submitted to the action of a heat of about 400° it undergoes the same isomeric change and is converted into dextrin; this transformation is most important, and is carried on, on a most extensive scale, in Lancashire and the north of England, a cheap substitute for gum Arabic being thus placed in the hands of calico printers to thicken their colours, and to enable the workman to apply them on the surface of fabrics, either by means of rollers or engraved blocks. As the orange yellow colour assumed by wheaten starch and potato farina under the influence of heat is often objectionable in a practical point of view, manufacturers mix the wheaten starch or the farina, with a small quantity of acid, and after having dried the whole, submit the mass to a comparatively low temperature, when the transformation of insoluble starch is effected, and soluble dextrin, nearly colourless, or patent gums, as they are called, are produced. For more technical details I must refer you to a paper which I had the honour of reading on the subject a few years since before this Society.*

It is scarcely necessary that I should state that starch is converted into dextrin and then into sugar under the influence of peculiar ferments. You will, I am sure, remember that I explained these transformations when speaking of the action of the saliva, and also that of the pancreatic glands in my lectures on animal physiology last year. You are also, I know, perfectly aware that it is a similar transformation which takes place in the brewer's vat under the influence of the albuminous ferment called diastase, when malt is converted into the saccharine fluid which is called "wash," and which is ultimately converted, by boiling with hops and fermentation, into that national fluid called beer or ale. With these facts before us we can not only appreciate the value of starch in seeds, plants, and fruits, but follow with interest the changes which it undergoes in order to become useful in the germination of the young plant, or in the ripening and sweetening of fruits. Most seeds, indeed I may say, all seeds, contain essentially two elements, one called starch, and the other albumen, a substance, as you are aware, which in the animal kingdom characterises the white of egg and the serum of blood. When a seed is placed in moist soil, and a gentle heat surrounds the whole, the albumen undergoes a molecular modification, and becomes a ferment, which differs from common albumen by the fact that it requires a much higher temperature to coagulate it. Under the influence of this ferment and the joint action of heat and the moisture which surrounds the seed, the starch is converted first into dextrin, and then into sugar, or, in other words, into such substances as are soluble, susceptible of being absorbed, fixed, and transformed into such elements as will constitute the tissues of the young plant. I shall have the pleasure of showing you, as we proceed with this lecture, that when one chemical equivalent of starch has fixed two equivalents of water, and has thus been converted into sugar, it can unfold itself with great facility into either three equivalents of acetic acid or two equivalents of lactic acid, as shown by the following table:—

Sugar	C^{12} H^{12} O^{12}
Acetic acid, 3 equivalents	C^{4} H^{4} O^{4}
Lactic acid, 2 equivalents	C^{6} H^{6} O^{6}

These acids or similar ones dissolve the lime and other mineral matters surrounding the seed, thus carrying to the young germ those mineral elements which it required to become a young plant, which, when once it has grown out of the seed and of the soil which surrounds it, puts forth leaves, which are susceptible of absorbing the carbonic acid of the atmosphere, thus fixing its carbon, which constitutes the framework of the young plants. This carbon, united with the elements of water and nitrogen, gives rise to all the vegetable substances necessary to constitute the vegetable matter of full grown plants.

The ripening and the sweetness of fruits are due to the conversion of starch into sugar, but although this conversion is effected by the presence of acids in the fruit, still they are not exactly the same as those which exist in the young seed, and therefore this peculiar transformation of starch into sugar in fruits deserves our special notice. The predominant acid in green fruit is called malic acid, which partly disappears as the fruit proceeds towards its maturation, whilst the greater part unites with the sugar it has helped to produce.

In fruits and in bulbs there exists another substance which presents to us a peculiar interest. It is a white, gelatinous mass, insoluble in water, and is called pectose. It is also accompanied in fruits and bulbs by its ferment, called pectase, the same as starch is accompanied by its ferment, called diastase. As time proceeds, the pectase acts upon the pectose, and converts the insoluble substance pectose into the soluble substance called pectine, which is a neutral substance, but which in its turn is converted into an acid called pectic acid. This acid, in connection with malic acid, sometimes converts the starch contained in fruit into sucrose, or cane sugar, fructose, or fruit sugar, which I may here state differs from cane sugar in not crystallising with the same freedom, is not so sweet, and also contains two chemical equivalents more of water. The transformations of pectose into pectine and pectic acid are isomeric changes, and therefore are most easily effected in nature. The following table will clearly demonstrate the truth of this assertion:—

Pectose	C^{64} H^{40} O^{56}, 8 HO
Pectine	C^{64} H^{40} O^{56}, 8 HO
Pectic acid.....	C^{64} H^{40} O^{56}, 4 HO
Metapectic acid	C^{64} H^{40} O^{56}, 16 HO

It may be interesting to some of my hearers to know what changes take place when fruits are converted into jelly or marmalades; and whilst on this subject I may state that there is no doubt that a part of what is sold as Scotch marmalade is made from carrot juice, sweetened with a little sugar, and rendered bitter with peel of the bitter Seville oranges. I have the pleasure to present to you some marmalade and jellies that have been made from carrots, and which, from their quality, leave no doubt that, with a little skill and practice, a very agreeable condiment can thus be produced. But setting this aside, let me state that when fruits are heated, the pectase converts the pectose of the fruits into pectine, and if then sugar is added and the whole filtered, the pectine solution, as it cools, becomes gelatinous, and constitutes the ordinary fruit jellies; but ladies or cooks must take great care not to boil these too long, or they will get into a chemical difficulty, for, under the influence of heat,

* See *Journal*, Vol. VIII., p. 87.

pectine will first be converted into pectic acid, and then into metapectic acid, when no jelly will be produced. Therefore, great care must be taken not to boil the fruit syrup with the sugar more than a few minutes before it is clarified with a little albumen, or white of egg, filtered, and allowed to cool.

Having thus studied some of the interesting conversions of starch into sugar, under the influence of artificial and natural chemical influences, let us examine together the transformations which sugar is capable of undergoing under various chemical and molecular actions; and this cannot fail to interest you, as man has availed himself of these transformations to obtain some of the most abundant and valuable products which he employs, either for his health or as a beverage. It is especially the transformation of sugar into alcohol on the one hand, and the conversion of alcohol into various products; and on the other hand, the transformation of sugar into mannite, the sugar of manna, or its conversion into lactic acid and butyric acid, that I wish to dwell upon for a few minutes. Several of the conversions of sugar into other substances are effected under the peculiar action of certain ferments, which ferments are microscopic plants or animals.

Having already explained the conversion of sugar into alcohol by means of a ferment, and the further transformation of that alcohol into acetic acid by another ferment—the one called *mycoderma vini* and the other *mycoderma aceti*, — it would be loss of time to enter again into the subject here; but there is one fact which has come to light since then, and which appears to me sufficiently interesting to justify my calling your attention to it. I stated last year that many of the diseases to which wine is subject were not due, as was believed, by chemists and others, to mere chemical transformations of the various substances constituting that liquid, but to peculiar and well defined ferments which develope themselves in that fluid under special circumstances, and which are the cause and the source of various classes of disease to which wines are liable. The knowledge of these facts has proved most valuable, for it has enabled M. Pasteur to devise a very simple method for arresting the decomposition or decay of wines. M. Pasteur's plan consists in heating diseased wine to a temperature of about 130°, when the ferments are destroyed, and all that is necessary to restore the wine to its original state, is to allow the dead ferments to settle as a deposit, and then to decant the wine.

I may state here, *en passant*, that a M. Lamotte has proposed and carried out with success a method of "ageing" wine rapidly. It consists in submitting the wine for a few days to a temperature of about 100°, when it will be found that after allowing the wine to stand for a short time, it has acquired the flavour of a seasoned vintage.

Let me resume the subject of my lecture by stating that the transformation of sugar into mannite is also due to a peculiar ferment, which is a modification of the *mycoderma vini*, for this ferment is produced by boiling in water the ordinary one, and then mixing the so boiled ferment with a saccharine fluid; a very slow fermentation ensues, the saccharine solution becomes viscous, and if then its composition is ascertained it is found to be represented by a gummy, neutral, viscous substance, and a crystallised white matter, called mannite, one of the chief constituents of manna, which is used as a purgative in pharmacy. If instead of introducing into a sugar solution one of the above-mentioned ferments, it is mixed with albumen, or the curd of milk, or several other animal substances, and chalk added, after a short time the mass assumes a thick gelatinous appearance, and if then it is chemically analysed, it will be found that the sugar has unfolded itself into lactic acid, each equivalent of sugar giving rise to two equivalents of this acid, a substance which is found to characterise the acidity of milk, and which also exists in the gastric juice of man and many other animals, also as acid lactate of lime in the muscular flesh of man and of animals, and which, lastly, is also a constant product in the slow fermentation of flour, in warp-sizers' vats, and in curriers' clearing pits. We thus observe the value of a science which is able to trace, to define, and to characterise the production of a substance from its original source, namely, starch, or sugar, into the stomach of man, and to proceed from thence into the manufacturers' operations such as those which we have just mentioned. A science which can so well trace the production of a substance and its influence in the medium in which it is found to exist, and can give, as I have shown in my former lectures, an explanation of the various functions it fulfils in the instances I have cited, must be indeed a science worthy of your attention, and worthy of the encouragement of the members of this Society.

There is still another transformation of sugar, through the medium of a ferment, which is not less curious and instructive than those just referred to. Here the transformation is not due to a vegetable ferment, but has been traced and proved to have its source in animal life. The ferment is represented by a little microscopic straight figure having a vibratory motion, and hence called *vibrio*. These microscopic animals transform sugar into that noisome fluid which characterises rank butter, called butyric acid, and which substance in its turn can be transformed, as I shall tell you in my next lecture, into a compound called butyric ether, sold in large quantities as the fruit essence of pineapple, used extensively for imparting that flavour to sugar drops.

Since I delivered this lecture to the Society of Arts, there has appeared a paper by M. Bechamps, which presents such a peculiar interest that I must be excused if I here introduce it to the notice of the reader. This learned chemist has gone a step further than Ehrenberg, who stated that most of the chalk formations were represented by the remains of microscopic animals, several of which, by the perfection of their fossils, he was able to define and name. But Bechamps has discovered that, besides the remains of antediluvian periods, there exist at the present time large quantities of microscopic animalculæ, which he has named *Microzyma cretæ*; found by him to exist in the centre of large blocks of chalk, taken out at a depth of 200 feet under the surface of the soil by means of a tunnel driven into the sides of a mountain; what enhances the interest of this discovery is that if some of this chalk is placed in a saccharine solution, butyric and lactic fermentation ensue.

Having thus studied the series of molecular and chemical actions, by which starch is transformed into sugar, dextrine, glucose, alcohol, acetic acid, mannite, lactic acid, and butyric acid, let us still pursue the interesting transformations of sugar into one or two more products. Thus, if starch or sugar is mixed with peroxide of manganese and sulphuric acid, and heat is applied, a most violent chemical reaction ensues, and the most important product thus generated through the oxidation of the sugar or starch by the oxygen of the oxide of manganese, liberated by its contact with sulphuric acid, is an acid referred to in my last lecture, namely formic acid, a substance found to characterise ants, the artificial production of which acid I described to you, by methods which have been devised by M. Berthelot. Again, if we take starch or sugar, and act upon it with nitric acid or aquafortis, we shall convert it into a white crystalline substance, oxalic acid, which for many years was entirely extracted from a wild plant called *Oxalis acetocella*, which in fact was the only known source of obtaining a substance so extensively used by the cleaners of straw-bonnets, and in calico-print works, as well as by the careful house-

keeper to remove iron-moulds from linen. At the present day, through the progress of chemistry, a pound of oxalic acid is not dearer than an ounce was formerly, for not only is oxalic acid obtained by the action of nitric acid on sugar, but it is also produced in large quantities at Warrington, in Lancashire, by Messrs. Roberts, Dale, and Co., through the action of a mixture of caustic soda and potash on sawdust, where under the oxidising influence of the alkali incited by heat, the lignin, or fibre of the wood, which has an isomeric composition with that of starch, is oxidised and converted into oxalic acid. It would carry me far beyond the limits of a lecture were I to examine in detail how those substances in their turn can be converted into others, or the numerous classes of substances to which they give rise. I must, therefore, content myself with examining with you generally the subject under consideration, leaving details for the student. It will be easy to conceive what an amount of useful information the student will derive from such a pursuit; and you will see this more clearly if I lift up a corner of the veil, and give you an insight into those treasures of information. Let me, therefore, refer to some of the transformations of alcohol, a substance so well known to all of us by its presence in most of the beverages we take, and also from its extensive employment in arts and manufactures.

The conversion of alcohol into ether, presents one of the most interesting and remarkable instances known in chemistry, of the unfolding of a substance into two others, under the influence of certain molecular forces, known to chemists (but yet badly explained), as actions of contact, or catalytic actions; that is to say, that science has observed several instances where a substance, when placed in the presence of another, under stated circumstances, will undergo special chemical decompositions, quite different from those which it will experience if the other substance is absent. The unfolding of alcohol into ether and water is a remarkable example of this class of molecular actions. Thus, if 70 parts of strong alcohol are carefully mixed with 100 parts of concentrated sulphuric acid or vitriol, and the whole allowed to remain for a few hours in contact, and are placed in a retort, to which heat is applied, so as to raise the temperature to 284°, it will be observed that one molecule of alcohol will split itself into one molecule of ether and one molecule of water. If such a transformation was to stop there, interesting as it is, it would be only similar to many others which I have brought before your notice. But such is not the case; for if in the heated fluid a small continuous stream of strong alcohol is introduced, it will be found that as the alcohol reaches the heated mass it will unfold itself into water and ether, which distil and still keep separate in the condensed part of the apparatus or receiver. Therefore, under the influence of a compound called sulpho-vinic acid, and heated at 284°, the alcohol which is introduced in such a mass is unfolded, as just stated, into two compounds which cannot unite, though they were united before they came in contact with the sulpho-vinic acid, or had experienced the catalytic action of the sulpho-vinic acid or sulphuric acid.

I hope you do not forget that in my last lecture I called your attention to another action of sulphuric acid on alcohol, viz., that if three-parts of sulphuric acid were mixed with one of alcohol, and heat applied, the sulphuric acid, instead of separating one equivalent of water from the alcohol, so as to transform it into water and ether, would in that case remove two molecules of water, retain them, and liberate a gas which we called olefiant or ethylene. If, instead of acting upon alcohol with sulphuric acid, we act upon it with nitric acid or aquafortis, we produce nitric ether, or, what is commonly called spirit of nitre; and if we mix alcohol with acetic acid, or, what is still better, with a mixture of acetate of soda and sulphuric acid, we obtain a most agreeable perfumed substance called acetic ether, which contributes largely to the flavour of wines and spirituous liquors. In fact, a great variety of compound ethers can be produced by bringing alcohol in contact with an acid, and applying heat; or, what is still more effectual, by bringing into play the action of still more powerful acids, such as sulphuric or hydro-chloric, which by their presence help the transformation of alcohol into those compound ethers so much used in medicine as therapeutic agents. Again, if to a mixture of alcohol and sulphuric acid a small quantity of manganese be added, and a gentle heat applied, a new substance is produced, differing entirely in its properties from that which results from the action of sulphuric acid and peroxide of manganese on sugar, for in that case formic acid is produced, whilst in the one now under consideration, the substance called aldehyde is generated, which substance is characterised by the remarkable property it has of reducing the salts of silver, instances of which you have no doubt often remarked in the metallic globes in shop windows, which present a brilliant reflecting surface, due to a silver deposit, resulting, generally speaking, from the reduction of a salt of silver, by means of aldehyde; lastly, this substance, which was two or three years ago a laboratory product, is now manufactured in large quantities, being used extensively for reducing, in conjunction with hypo-sulphite of soda, the splendid red tar colour known under the name of magenta, into that brilliant green which most of you have admired, under the name of *vert lumiere*, from the fact that it maintains not only its green colour by artificial light, but that under the influence of that light its intensity is greatly increased.

Proceedings of Institutions.

Metropolitan Association for Promoting the Education of Adults.—On Tuesday evening, the 9th inst., a meeting was held in the great room of the Society of Arts, for the purpose of distributing the prizes gained at the last examination of this association, including the prize given by Her Royal Highness the Princess of Wales. Harry Chester, Esq., a vice-president of the Society of Arts, presided, and there was a numerous assemblage of the friends of the successful candidates. The Chairman, in opening the proceedings, gave a brief explanation of the origin, objects, and practical operations of the association. The examinations instituted by the Society of Arts were confined to persons over 16 years of age. The Metropolitan Association was founded for the purpose of promoting the education of both sexes between the period when boys and girls leave school up to that age, as well as for promoting adult education in elementary subjects. There were two grades of examination, the lower and the higher. The candidates were examined by the examiners appointed by the association, in reading, writing, spelling tested by dictation, arithmetic, Gospel history, English history, geography; and female candidates were also examined in plain needlework, a subject which was regarded by the Committee as of the highest importance. Prizes for excellence in these various subjects were given, as well as for general proficiency. Feeling deeply the lamentable deficiency of religious knowledge, the association had also instituted examinations in this subject, and these were annually held, certificates and prizes being awarded by examiners appointed by the Bishops of London and Winchester, who sign the certificates. It was gratifying to find that the number of candidates for examination was increasing, though so strongly did he (Mr. Chester) feel the shocking deficiency which existed, not only on this subject, but almost every branch of knowledge, that he was individually in favour of a compulsory system of education. People were not allowed by law to ill-use each other, and he could imagine no

worse usage than to allow persons to grow up uneducated. After some further observations the chairman proceeded to distribute the prizes. In presenting the Princess of Wales' Prize, the chairman explained that when the Prince and Princess became the patron and patroness of the Association, her Royal Highness had kindly consented to give a prize for competition among the female candidates, which had this year been awarded to Ellen Louisa Woollard, of the Lambeth Evening Classes, who was the daughter of a carpenter in Lambeth, and who had been in domestic service. He had therefore great pleasure in presenting her, by command of her Royal Highness, with a handsome Bible and two guineas. In consequence of the absence of the Princess from London, she had not been able to attach her signature to the prize; but when her Royal Highness returned to London she would do so. The Rev. G. B. Macilwain, honorary secretary, introduced Mr. Larkins, the new secretary, to the meeting, and he was greeted with hearty applause. On the motion of Mr. Benjamin Shaw, M.A., chairman of the committee, seconded by the Rev. Mr. Bruce, a cordial vote of thanks was given to Mr. Chester, who had, in fact, founded, watched over, and brought the Association to its present position. The Chairman acknowledged the compliment, and after some remarks from Mr. Baker, of the West London Youths' Institute, the proceedings terminated.

PARIS EXHIBITION OF 1867.

The following is from a correspondent at Paris:—

The Imperial Commission has made an alteration in the conditions laid down respecting the time for sending in works of art for the Exhibition, which will give great satisfaction to artists, as well as other possessors of works of art. According to the original regulation, works intended for the great Exhibition were to be sent in for examination by the jury in the month of October; by the terms of the regulation just issued no work will have to be deposited before the month of January. In the first place artists are invited to send to the jury, during the first half of December, a written declaration, containing a description of the works they propose to exhibit, with their dimensions; the jury will examine these declarations, and admit works of known merit, and which they deem suitable for such an exhibition, without having the works themselves before them, which will only be required to be sent in between the 15th and 25th of February; those which are not admitted without previous examination will have to be deposited at the Palais de l'Industrie between the 5th and 20th of January, so that by the new regulations the time during which the works will be out of the possession of their owners is diminished by three months in one case and four months in the other. This revision of its regulations shows that the Imperial Commission is desirous of satisfying the legitimate complaints of the public, and not obstinately determined on maintaining an unpopular regulation.

An incident has just occurred in connection with the Fine Art portion of the Exhibition, which has caused much surprise and many comments. By the regulations of the Commission, one-third of the Fine Art jury was to be named by the Academy of the Beaux Arts, but the members of that branch of the Institute of France have declined to take any part of the work. It will be remembered that the management of the periodical, now annual, exhibitions of modern works of art, as well as the direction of the School of Fine Arts, was taken away from the Academy three years since, by Imperial decree, and the members of the Institute now indicate by this refusal their determination not to accept a part of that power which formerly was all their own. It is impossible not to condemn this act of the Academy; its management of the exhibitions and of the educational establishment gave rise to loud complaints, and it is certain that the changes have been highly beneficial to both, and that the Imperial interference, absolute though it was, was highly acceptable to the majority of artists, as well as of the artistic world in general; and the refusal of the Academy will only strengthen the general opinion that institutions of that class do not partake of the progressive spirit of the age in which we live.

The regulations concerning the conveyance of objects to be exhibited have just been published. Productions of all kinds (objects of art and other valuables excepted), carriages and animals will be conveyed by the railways at one-half the usual charges, the minimum being, however, fixed at four centimes per ton per kilomètre, less than three farthings a ton per mile. The companies are however, in consideration of this reduction, absolved from all responsibility whatever as regards accidents to animals thus conveyed. Works of art and other valuable objects to be charged at the ordinary rates. The diminution of the tariff does not, however, apply to objects weighing more than ten tons, or of dimensions exceeding that of the material of the railway, but locomotives, carriages, and tenders, which can be placed on the rails, are included. Objects weighing less than 1,200 kilogrammes (1¼ ton) will be conveyed by cart from the termini to the Exhibition building, and those which exceed that weight by means of the circular railway which will connect all the termini with the railway station just without the grounds of the Exhibition. All charges to be paid to the Exhibition, but on reception when returning. The reduced tariff to apply to objects returned from the Exhibition within six months of its closing.

INUNDATIONS IN FRANCE.

The waters have happily retired to their proper beds; engineers are everywhere at work repairing the mischief done, and providing, as far as possible, against the effects of another flood, while the unfortunate sufferers are counting their losses, and pressing wants are being met by contributions headed by the Emperor.

The inundations have extended to the departments of the Seine, Seine-et-Marne, Allier, Loiret, Loire, Haute-Loire, Yonne, Côte-d'Or, Lozere, Lot, Savoie, Nièvre, Corrèze, Dordogne, and Lot-et-Garonne. Fortunately, the Rhone and the Gard, although swollen, have not overflown their banks, and the Garonne, which for a moment was swollen to repletion, diminished almost immediately without having caused any serious mischief.

The Seine continued to rise at Melun, the chief town of the Seine-et-Marne, until the evening of the third instant, since which time the level has continued to diminish.

Nantes and its neighbourhood have suffered terribly; on the 2nd instant the Loire had reached to nearly the level of the flood of 1856, and the river was still rising. The railway, as well as the embankments of the river, were broken down between Saint Martin and Saumur, the embankments of the River Divatte were expected to give way, and the slate quarries of Angers to be inundated. The streets in the lower part of the town of Nantes were filled with water, and the country around was under water to the extent of three or four miles. The telegraph poles were thrown down, and for two or three days there were no means of communication with Nantes. The plains around Gien are still under water, the banks of the canals having given way; the road to Châtillon and the railway are both broken up. In the Maine-et-Loire, the banks of the Loire have only given way in two places, namely, at Gohier, on one side, and near Saint Martin de la Place on the other. In the latter case, the railway formed a barrier against the waters, but they soon made a breach to the extent of more than sixty yards in length and seven or eight in depth; beyond this was the embankment for the pro-

tection of the fertile valley of Authion, which skirts the Loire and extends as far as Trelazé; the flood soon made a similar breach in this, and the whole valley was submerged. Trelazé was saved by an embankment constructed after the terrible floods of 1856. At Nevers, the Haute Loire rose, on the 25th and 26th of September, seventy inches in twenty-two hours; at Orleans it rose at the rate of nearly five inches per hour. The lines of the Lyons and Orleans railways have suffered severely; the following is a report made by the former company on the 3rd instant:—"The circulation is re-established, since the morning of the 2nd instant, between Orleans and Vierzon, and a provisional service for passengers has thus been made between Paris and Bordeaux. The line was either broken or under water at Ambroise and St. Pierre des Corps, on the road between Blois and Tours, and gangs of workmen are engaged in repairing the mischief as fast as the waters recede. The station of Tours has escaped, and consequently the service was not interrupted between Mans and Bordeaux. The line between Tours and Nantes was interrupted near Langeais, at Saumur, and near Ancenis, and it is difficult to form an idea at present of the amount of damage done, but the company believe that it will prove to be considerably less than it was in the year 1856." This report gives a vivid notion of the extent of the inundation in the part of the country to which it applies. Nevers, Gien, Montargis, Château-Renard, and Châtillon have all suffered severely.

The rivers Yonne, Lot, Dordogne, and Tarn have all overflowed their banks more or less. Savoie seems to have suffered very severely; besides the destruction of the great high road to Italy, mentioned last week, the Arc overflowed, destroyed the railway in several places, and created other terrible devastations. The railway between Saint Jean and Saint Michel will, it is feared, take a long time to repair. The official *Gazette* of Italy says that, according to reports from the French authorities, the Mount Cenis route was free on the 2nd instant, and the postal route re-established, but with inevitable loss of time, from the necessity of conveying the mails on the backs of mules from Saint Jean to Lanslebourg.

Accounts from Perpignan of the evening of the 2nd inst. say that the Agly has overflowed, and laid the vineyards of Rivesaltes, and part of the plain of Salamanque under water, that the Têt had also broken its limits, and the rain was descending in torrents. It may be remarked that on the Lyons and Orleans line, where the inundations were so terrible the other day, the weather was almost uninterruptedly beautiful, and the skies brilliant; this remark applies to the last few days of September and the first three of October.

Happily the destruction of human life seems to have been but small, but the loss of the farmers and peasants, in cattle, grain, fodder, and growing crops, is enormous; the damage done in the department of the Ardèche is estimated at about thirty thousand pounds, and the mischief there is nothing as compared with that in other districts. Some strange accidents occurred amidst the general desolation. In the neighbourhood of Nemours a whole party were surprised by the waters, and driven to the upper floors of the house, where they were prisoners for thirty hours; and in a meadow in the same neighbourhood which the water had covered but retired from was found, at a great distance from any habitation, a heavy chest of drawers full of linen, for which no owner could be found.

The Emperor has headed a subscription on behalf of the sufferers with the munificent sum of £4,000, to which the Empress has added £1,000, and the Prince Imperial £400; the example thus set has been well followed, and the lists published to the present time, and including the contributions of all classes, from the 20,000 francs subscribed by Baron James de Rothschild to the 50 centimes of the poor couturière, make up a very large amount.

NITRO-GLYCERINE IN THE SANDSTONE QUARRIES OF THE VOSGES, NEAR SAVERNE.

The explosive properties of nitro-glycerine [$C^6 H^5 (NO^4)^3 O^6$], and the results of experiments made with this substance in various parts of Sweden, Germany, and Switzerland, have induced Messrs. Schmidt and Dietsch, proprietors of extensive sandstone quarries in the valley of the Loire (Bas Rhin), to try it in their workings.

These experiments have been successful both as regards economy, facility, and rapidity of work, and the use of powder has been temporarily abandoned, and for the last six weeks only nitro-glycerine has been used for blasting purposes in these quarries.

1. *The preparation of Nitro-Glycerine* is commenced by mixing in a vessel, placed in cold water, fuming nitric acid, at 49° or 50° Baumé (1·476 or 1·490 sp. g. English), with double its weight of the strongest sulphuric acid. (These acids are both expressly manufactured at Dieuse and sent to Saverne.)

The glycerine of commerce, which should be free from lime and lead, is evaporated in a vessel until it indicates 30° to 31° Baumé (1·245 and 1·256 sp. g. English). This concentrated glycerine should become solid when completely cold. A workman then pours 3,300 grammes (about 7¼ lbs.) of the mixture of sulphuric and nitric acids, well cooled, into a glass vessel (a stone pot or porcelain vessel will equally answer the purpose), placed in a trough of cold water, and then pours slowly, while gently stirring it, 500 grammes (1lb. 1oz.) of glycerine. The most important point is to prevent a sensible heating of the mixture, which would cause a rapid oxidation of the glycerine with the production of oxalic acid. It is for this reason that the vessel, in which the transformation of glycerine into nitro-glycerine takes place, should be constantly kept cool externally with cold water.

The mixture being stirred well, it is left for five to ten minutes, and then it is poured into five to six times its volume of cold water, to which a rotating motion has been previously given. The nitro-glycerine is rapidly precipitated in the form of a heavy oil, which is collected by decantation in a deep vessel; it is then once washed with a little water, which is also decanted, and then the nitro-glycerine is poured into bottles ready for use.

In this state the nitro-glycerine is still a little acid and watery; but this is no drawback, as it is used shortly after its preparation, and these impurities in no wise impede its explosion.

2. *Properties of Nitro-Glycerine.*—Nitro-glycerine is a yellow or brownish oil, heavier than water, in which it is insoluble, but it dissolves in alcohol and ether. Exposed to a cold, even slight, but prolonged, it crystallises in long needles. A very violent shock is the best mode of making it explode. Its management is otherwise very easy, and not dangerous. Spread on the ground, it is difficult to make it take fire with a lighted match, and even then it burns but partially. A flask containing nitro-glycerine may be broken on stones without exploding it; it may be volatised without decomposition if carefully heated; but if the ebullition becomes brisk explosion is imminent.

A drop of nitro-glycerine falling on a cast-iron plate moderately hot, volatilizes quietly; if the plate is red-hot, the drop inflames immediately, and burns like a grain of powder, without noise; but if the plate is hot enough, without being red-hot, for the nitro-glycerine to boil immediately, the drop is briskly decomposed, with a violent detonation.

Nitro-glycerine, especially when impure and acid, may decompose spontaneously after a certain time, with release of gas and production of oxalic and glycolic acids. It is probable that spontaneous explosions of nitro-glycerine, the disastrous effects of which the newspapers have made known, are occasioned by a similar cause. Nitro-glycerine being enclosed in well-corked bottles,

the gases produced by its spontaneous decomposition cannot release themselves; they exercise a very great pressure on the nitro-glycerine, and under these circumstances the least shock and the slightest shaking may occasion an explosion. Nitro-glycerine is of a sugary, sharp, and aromatic flavour; it is also a poisonous substance. In very small doses it occasions very severe headaches. Its vapour produces like effects, and this circumstance might well be an obstacle to the use of nitro-glycerine in headings in mines, where the vapour could not be dispersed as easily as in open quarries.

Nitro-glycerine is not a properly nitrous compound, analogous to nitro-, or binitro-benzol, or to the mono-, bi-, and tri-nitrophenisic acids. For instance, under the influence of reducing bodies, such as hydrogen, glycerine is set at liberty, and caustic alkalis decompose nitro-glycerine into nitrates and glycerine.

3. *Methods of using Nitro-Glycerine*—Supposing that it was required to detach a mass of rock at 2.50 metres or three metres (8 to 10 ft.) distance from the external edge; a hole is drilled about two to three metres (from 6ft. 6in. to 10ft.) in depth, five to six centimetres (2 to 2½ inches) in diameter; after having cleared this hole of mud, water, and sand, 1,500 to 2,000 grammes (3lbs. to 4½lbs.) of nitro-glycerine are poured into it by means of a funnel. A small cylinder, in wood, card, or tin, of about four centimetres in diameter and five to six centimetres (1⅝ inch, 2 to 2½ inches) in height, filled with powder, is then put in. This cylinder is attached to a fuze, that penetrates it a short distance, to ensure the explosion of the powder. By means of this the fuse is lowered to the surface of the glycerine, which is known by practice.

The fuse is then held steady, and fine sand is run in until the hole is entirely filled. It is unnecessary to compress or plug up the sand. The fuze is then cut off a few inches above the hole and lighted. At the end of a few minutes the fuze burns down to the cylinder and ignites the powder, which occasions a violent shock, and causes the nitro-glycerine instantly to explode. The explosion is so quick that the sand never has time to be thrown out. The whole mass of rock is raised up, displaced, settles quietly down without any being projected, and a dull report is heard. It is only on the spot that any idea can be formed of the immense force developed by the explosion. Formidable masses of rock are easily displaced, and cracked every way, and ready to be cut up by mechanical means. The principal advantage is that the stone is but little crushed, and there is but little waste. With charges of this nitro-glycerine 40 to 80 cubic metres (1,400 to 2,800 cubic feet) of pretty hard rock may be detached.

SORGHUM SUGAR.

The following is from a recent number of *Once a Week*:—

"A Sugar-yielding grass has recently been introduced into the south of Europe and North America, the cultivation of which has extended with wonderful rapidity in the United States, in regions far to the north of those adapted to the sugar-cane. It has long been cultivated in China and in Africa, partly for the sake of the sugar which is made from it, partly for its seeds, which are a good grain, similar to the Durra so extensively cultivated in the East Indies and in Africa. Durra (*Sorghum vulgare*), also known as Sorgho and Indian Millet, may almost be said to be the principal corn-plant of Africa: and the Sugar-grass, or Shaloo (*Sorghum saccharatum*), may be regarded as a superior kind of Durra. Its seeds are much larger than those of the common kinds of millet, and although the meal does not make good bread, it is very nutritious and pleasant, and is prepared in various ways as an article of food. Its productiveness exceeds that of most kinds of corn, almost rivalling the productiveness of maize. It is a tall grass, from four to eight feet high, with a diffuse and very spreading panicle. As a corn-plant, however, no attention has yet been paid to it either in Europe or in America; whilst, as a sugar-yielding plant, it has obtained an important place in agriculture. It is cultivated only to a small extent in the south of Europe, and particularly in the Veronese. Its value does not seem to have been appreciated by European farmers as it has been by those of North America, whose enterprise and perseverance have quickly turned it to great account. It can be cultivated with profit as far north as the state of Maine, and probably wherever the vine and maize can be cultivated, requiring like them a hot summer, and of about the same duration which they require. It is not, therefore, adapted to the climate of Britain, where it can only be expected to succeed in the warmest parts of England.

"The Sugar-grass was introduced into Europe by the Count de Montigny, the French Consul at Shanghai, in 1851. Of the package of seed sent by him to the Geographical Society of Paris only one seed germinated. From this single plant a small quantity of ripe seed was obtained. Messrs. Vilmorin, Andrieux, and Co., seed merchants in Paris, purchased eight hundred seeds derived from it, and paid eight hundred francs for them. Another portion of the same crop passed into the hands of the Count de Beauregard, and from these sources this seed was distributed over Europe, and thence over America. The first seeds were carried to America in 1857. Two years after, Mr. Wray brought seed from Africa to America, and two classes or varieties are now recognised there, the Chinese, or *Sorgo*, and the African, or *Imphee*. In 1862, more than 100,000 acres were devoted to the cultivation of the Sugar-grass in the United States, yielding at least 16,000,000 gallons of syrup. The extent of land thus employed has increased since that year, although the crop of 1863 was almost a failure, through a very early frost. The cultivation of the sugar-grass has hitherto been chiefly carried on in the North-Western States—Ohio producing in 1862 more than 6,000,000 gallons of syrup, and Iowa nearly 4,000,000. The Eastern States have, however, begun to engage in it.

"Mills of various kinds are employed for crushing the cane and expressing its juice. A minute description of these is unnecessary. One in common use consists of three horizontal rollers, an upper one resting on the other two. Mills with vertical rollers are also employed. The mills are wrought either by steam, water, or horses. Great part of the sugar-grass grown in America is crushed by the farmers themselves in small mills, and much of the syrup is used without being converted into sugar. The juice, as it is obtained from the mill, contains many impurities—dust and earth, small fragments of cane, and green vegetable matter. These are in part removed by filtering, and a filter of straw is often employed. They are removed more completely by skimming during the boiling of the juice, but, if no further means are adopted, so much of them still remains as to give the syrup a dingy appearance. The processes employed in procuring sugar from the sugar-cane in tropical countries are equally applicable in the case of the sugar-grass."

Fine Arts.

PHOTOGRAPHS OF NATIONAL PORTRAITS.—Photographs were taken of no less than one thousand portraits in the recent exhibition at South Kensington. This number is within thirty of the entire collection. The owners of some few portraits objected to photographs being made, and there were besides some pictures which, from blackness or other causes, could not be photographed at all. The works, however, thus excluded, did not exceed three per cent. on the entire gallery. Of this interesting series of one thousand photographs, about three hundred are

now on view at the Kensington Museum, in a sale-room placed at the service of the Arundel Society. This business transaction is in accordance with an agreement recently made between that society and the Department of Science and Art. It may be remembered that some years ago an objection was raised by the trade to the production and sale of photographs by the government. Under the plan which is now about to come into active operation, the photographs will be executed by a professional man, and the sales effected through the agency of the Arundel Society. The latter receives a percentage on all sales effected. The price to the public has been graduated, at a moderate rate, on the area of each photograph, calculated in square inches. This arrangement extends not only to the national portraits, but also to all other works previously entered in the list published by the department. In addition may be noted photographs from the miniatures exhibited a year ago, and also from the Raphael and Michael Angelo drawings at Oxford. Orders for any one or more of these photographs are received at the Museum, or at the offices of the Arundel Society, Old Bond-street. This reciprocal benefit was recommended to the members of the society by the annual report, in the following words: "The desire to co-operate with an institution from which the society has received valuable support in former years, as well as the liberality of the terms offered, induced the Council to accede to this proposal." These terms, it is understood, will yield a profit to the Arundel Society, after the payment of incidental expenses, which profit will be devoted to the general purposes of the society in the promotion of art.

Lord Macaulay.—Mr. Woolner has completed in marble the statue of the late Lord Macaulay. The figure is seated, and draped in academic robes. The work has been placed, on loan, in the Kensington Museum, prior to removal for its final destination in Trinity College, Cambridge.

Brussels Exhibition—Results of various Rates of Admission.—The Brussels Exhibition of Fine Arts was to have closed on Monday, the 8th instant, but it is said the doors will be kept open some time longer. The experiment of various rates of admission supplies a few facts of importance. The rates charged were, during the first few days, number not given, two francs; during the following fortnight, one franc; for another fortnight, half a franc; and during four days and four Sunday afternoons, ten centimes only. The produce of the two-franc days was 2,345 frs.; one-franc days, 2,469 frs.; of the half-franc days, 10,359 frs.; and of the penny days, 7,928 frs. The principal points in the above account are, that the half-franc admission produced in twelve days and four Sunday mornings more than twelve days at a franc; and that four week-days and four Sunday afternoons, at a penny, produced more than three times the amount of the twelve days at a franc. The number of visitors on those four week-days, when the admission was only one penny, is surprisingly small, the highest being 2,500, and the total only 7,947, while the four Sunday afternoons at the same charge produced nine times the amount. The comparison of the Sundays is very remarkable. In 1863, four Sundays at one franc produced only 1,288 frs.; while this year, four Sunday mornings at half the rate of admission, produced 1,800 frs.; and four Sunday afternoons, at one penny, more than 7,000 francs.

Artists in France.—Everybody knows that artists abound in France, but few people are aware what a large portion of the population are actually engaged in the various classes of the fine arts, and in relation with them. The list drawn up for the election of the various juries for the award of the Grand Prix de Rome this year gives some notion of the popularity of the upper regions of art in Paris. In painting, besides MM. Ingres, Picot, Schnetz, Conder, Brascassat, Léon Cognier, Robert-Fleury, Signol, Meissonier, Cabanel, N. A. Hesse, Lehmann, Muller, Gérôme, members of the Institute, the list includes nearly fifty decorated painters, nearly all well known men. In sculpture we find MM. Dumont, Lemaire, Seutre, Jouffroy, Guillaume, Cavelier, Perraud, Gatteaux, of the Institute, and more than thirty others. In architecture, MM. Lebas, Lesueur, Hittorff, Gilbert, De Gibors, Duban, Lefuel, Baltard, all of the Institute, and thirty-three other artists. It must be remembered that this list includes only the names of those artists who were actually available at the moment in Paris, thus the names of M. Hamon and many other celebrated artists living at a distance, and those of several architects of high repute engaged on public works, do not appear in this long list of artists of acknowledged reputation and high standing. When we find that this list, diminished as it is by the limits assigned and the accidents referred to, contained more than one hundred and fifty names, we may form some idea of the importance of the art element amongst our neighbours. It is probable that a similar list drawn up by the Academy of Arts of Brussels would exhibit a still longer list of accredited artists, in proportion to the population of this city.

Manufactures.

Metal Manufactures in France.—For some time past, the French iron works have been receiving important orders for railway material from Belgium. The works at at Grafenstaeden (Bas Rhin) delivered, in 1864 and 1865, several locomotives for the Spa lines, to the frontier of Luxembourg, and to the Liege and Limbourg companies. At the end of last year the French establishments obtained the contract to furnish to the state railways a certain quantity of passenger carriages, which they have been able to construct at from 5 to 6 per cent. lower than the Belgian manufacturers. In a more recent contract the Société des Forges du Creusot tendered for the construction of nine goods engines for 56,800 francs each, and nine passenger engines at 57,500 each, in competition with a Belgian company, the prices of which were higher. The Société des Aciéries of Imphy and Saint-Sevrin continues in Belgium to obtain, at every competition, orders for numerous lots of tenders, wheels, axles, &c., in Bessemer steel, at lower prices than the English and Belgian manufacturers.

New Process for Bleaching Raw Wool.—M. Dullo, of Berlin, is stated to have discovered an economical method of bleaching raw wool, and thus imitating the bright white wool in the English trade. The wool is dipped into a solution of sulphate of magnesia, to which is added a certain quantity of bi-carbonate of soda; it is then slowly heated. Carbonic acid is then released, and the basic hydrated carbonate of magnesia attaches itself to the threads of wool and gives it a white colour. The wool evidently does not lose any weight. For 100 kilogrammes of wool, 5 kilogrammes of sulphate of magnesia, dissolved in water, and 3½ kilogrammes of bi-carbonate of soda should be employed. It should be heated to about 40° Reaumur, and then allowed to cool; the greater part of the precipitate is deposited on the wool, to the surface of which it adheres. The fixation of the carbonate of magnesia does not alter the softness and flexibility of the wood.

Ice-making in the Southern States.—There is an ice-manufacturing company at Shreveport, Louisiana, working on the ammoniac vapour principle, which has declared a dividend for three months, to the 1st of September, of eighteen per cent. The company now manufactures eight thousand pounds of ice per day.

California Silk.—A silk factory has been established at San Francisco, California, and some pieces of black silk, the first products of this native industry, are to be sent to the New York State Fair.

Fibre from Stalks of the Cotton-plant.—An in-

ventor in New Orleans has been turning his attention to the value of the stalk of the cotton-plant for the purpose not only of thread but of cloth, and is said to have succeeded in making the former strong, fine, and every way valuable to the industrial world. The article is described as soft and pliable, and capable of being converted into a serviceable fabric. One hundred and twenty pounds of stalk will turn out forty pounds of thread. A factory is to be established, for the manufacture of thread and cloth, at an early day. This discovery is not new, but the application of the discovery has never been made till now. It has long been known that the fibrous substance in the cotton-stalk bore a strong resemblance to the fibre of flax, but the test of its adaptability as a textile material is now for the first time made.

Commerce.

Cochin China a Future Sugar Country.—"The new colony of France in Cochin China," says the *Demerara Colonist*, "is a really fertile spot; its rice fields, salt works, and fisheries yielding considerable harvest and large exports. The French authorities declare that it is likely not far hence to become a most important sugar-growing country. Several parts of the colony are described as admirably adapted to the sugar-cane, which is largely cultivated by the natives for their own use. There are great numbers of sugar-houses, producing various kinds of sugar, according to the nature of the soil and the modes of culture and working, some of which are described as excellent. There are four varieties of sugar-cane grown in Cochin China—the white, red, green, and the red and white, but the first of these gives the best results in the hands of the natives. The sugar obtained from it is tolerably white. A good deal is also made from the red cane; but, in consequence of the imperfections in the modes of manufacture, the sugar is almost black. The canes are planted about the month of January, after the soil has just been turned over once, and on good lands the first crop is obtained in twelve months. During the two following years, without any more labour, they get further crops of cane. The cane when cut is crushed in rough stone mills, and the juice is received in holes in the ground, from which it is taken to be evaporated. Fresh sugar-cane is sold in all the markets at an exceedingly low price as a sweetmeat, of which the lower orders of the Annamites and the children are excessively fond. The buffaloes relish the cane trash immensely. With such a climate as that of Cochin China, which, in addition, possesses extraordinary means of transport, it is not hard to believe that before long it may become a large sugar-producing country. Indeed, there seems no reason why Cochin China should not eventually supply us with a good deal of sugar, and possibly tea also, as well as rice and spices."

The Chinese Yam.—The Chinese yam is justly esteemed for its agreeable flavour, the size of its tubers, and the facility with which it is cultivated in almost barren lands. The yam has the defect of the root increasing in length to the detriment of its thickness. Skilful growers have discovered a method of preventing this. The most efficacious mode is pinching off the lateral shoots, and thus forcing the sap to flow towards the central stem. A hectare of yams may yield from 25 to 40,000 kilogrammes of roots, and cultivated as a vegetable the yam is wholesome, savoury, and even delicate, and soon will cease to be the privilege of the wealthy when all the small and poorer cultivators know how to cultivate it. Its stem is climbing, as that of the hop or clematis; it may be supported, like peas or beans, by means of sticks. The ends of the lateral shoots are pinched off only, and towards the month of September, when the stems within the roots are taken up. To reproduce the yam, the upper part of the tuber, which is thin, tough, and furnished with smaller roots, is planted; the lower part, which is large and tuberculous, is reserved for consumption. The yam may also be reproduced by seed; and by this means fresh varieties are obtained. The yam is cooked in the same manner as the potato.

Bell-Founding.—Mr. H. M. Blews, in his contribution to the recently published work, entiled "Birmingham and the Midland Hardware District," writes:—This trade seems to have been unknown in Birmingham till the middle of the last century, when a foundry was in existence opposite the "Swan" at Good Knave's End, on the road to Harborne. This foundry supplied peals of bells to three adjoining parish churches in 1760. Twenty years later, one Ducker had a foundry at Holloway Head, and cast chimes, since which time there is no record of large church bells in peals having been cast in the town, although an extensive trade in other descriptions has continued to flourish and extend. Church, school, plantation, factory, and ship bells still closely adhere to the mediæval type. They vary in size from half a hundred-weight to half a ton, the largest size now cast in Birmingham. There is a great demand for them in the home and nearly every foreign market, including South America and the Colonies. Railway and dinner bells, from four to seven inches wide at the mouth, with a wooden handle attached, are largely used for domestic purposes; and the majority of railways in England, India, Russia, Brazil, &c., have been supplied from Birmingham. Musical hand-bells are still made, but the demand is very limited, as they are seldom required by any but village ringing clubs. Cattle and horse bells are oblong at the mouth, the size varying from three-and-a-half inches by two-and-a-half inches, to seven inches by three-and-a-half inches. They have conical sides, and a square iron loop at the top. They are in great demand for Australia and New Zealand, the smaller sizes being suited to the Brazilian and South American markets. Sheep bells are circular at the mouth, and an elongated semi-circle in shape, with a loop at the crown. They are used in England, and exported to the Cape, Australia, New Zealand, &c. House bells are so familiar as to need no description. Some exceedingly small bells, from $\frac{3}{4}$ to $1\frac{1}{2}$ inch, are used as an article of barter in the African trade. Sleigh, dray, and caparison bells, small circular bells, with an iron ball cast inside, are largely used in Canada and India, and command a limited sale at home. During the last ten years an increasing demand has arisen for fancy, table, office, and call bells, constructed of the ordinary clock-bell, mounted on a stand, and struck by the pressure of a spring. Not very long since, Messrs. Scholefield, Sons, and Goodman executed an order for 10,000 green bronzed and lacquered house bells, 12oz. in weight, for a West African Prince, to adorn his new iron palace. Messrs. J. Wilson Browne and Co. recently also received an order from another African prince for a number of polished ship bells, in elegant brass frames, and mounted on mahogany stands, some of which were engraved with the name assumed by the distinguished potentate, "Yellow Duke, Esq."

Colonies.

South Australian Immigration.—A colonial journal, giving an account of a monster meeting recently held in the Adelaide Town Hall, when a memorial to the Governor was adopted, deprecating the continuance of immigration at the public expense, says:—"It is natural that working men out of employment should object to the introduction of other working men to compete with them in the labour market, with the apprehended consequence in the reduction in the rate of wages. When men are in full work very little is said about immigration, but when work is slack the stoppage of it is put forth as the leading object. On the subject of immigration, it must be borne in mind

that a large portion has been assisted or nominated immigration, the working classes themselves contributing to bring out their own poor relations and friends, and asking Government to help them. This fact is overlooked by some of the public speakers upon immigration, who argue as if every immigrant was imported slowly to compete with previous arrivals. It appears South Australia is on the eve of a change in her career. It is said she will soon have to look for markets for her serial produce; and late droughts have caused much temporary and perhaps permanent damage to her pastoral prospects. Whether it is necessary to stop or check immigration for some time to come is a very important and vital question, and a great cry is raised about prosecuting public works."

Demand for Labour in New Brunswick.—Owing to the prosperous condition of this colony, there has been a large demand for skilled and unskilled labour, particularly in farming and ship building. Government has offered encouragement; and parcels of 100 acres can be purchased for the small sum of £10 10s., for cash payment, or 2s. 6d. sterling per acre, in which case three years are allowed to complete the payment; and by another mode the emigrant can obtain land by the Labour Act, and under this act no money payment is required. The conditions are that the holders of 100 acre lots shall cultivate during five years five acres, and there are nearly 200,000 acres of land in 100 acre lots, lying in nearly every section of the province. There is also a good demand for agricultural labourers, servants, and boys and girls.

New South Wales Aborigines.—For the first time for many years in New South Wales the blacks have shown themselves troublesome. They assembled to the number of about 400 on one of the Riverina districts, and enjoyed themselves with a model feast procured from the herds of the squatters, a large number of cattle having been speared. The men of the adjacent stations collected to drive the blacks away, but the latter showed fight, and the whites retired to seek the aid of the law.

Population of New Zealand.—The following is the population of the several provinces:—

Provinces.	1861.	1864.
Taranaki	2,044	4,374
Hawke's Bay	2,611	3,770
Nelson	9,952	11,910
Canterbury	16,040	32,276
Auckland	24,420	42,132
Marlborough	2,299	5,519
Wellington	12,566	14,987
Chatham Islands	50	86
Otago	27,163	49,019
Southland.....	1,876	8,085
Total.....	99,021	127,158

—showing an increase during three years of 73,137 persons.

Publications Issued.

Electricity. By R. M. Ferguson, Ph.D. (*W. and R. Chambers.*) This volume forms one of the "Chambers Educational Course." It aims at giving a popular and accurate view of the main principles of the science of electricity, and prepares the way for the technical or mathematical study of them. The work is divided into six sections, each section into chapters, and each chapter into paragraphs. This division is made with the view of conveying a clear idea of the connection of the main branches of the science, and of the various phenomena included under each. The fluid theories of electricity, on which the more usual terms of the science are based, are explained at sufficient length. They are apt, however, to convey the idea that electricity is a principle distinct from matter, an impression not borne out by experience. Throughout the work electricity is looked upon as a peculiar action which the molecules of matter under certain conditions exert on each other. A method of explanation is adapted in keeping with Faraday's theory of induction, and the manifest action of induction, in which it is assumed that electric action is one of contiguous molecules, and that nothing but molecular action travels as a current; at the same time each action is clearly described as it occurs apart from theoretical considerations. The British Association unit of resistance is adopted in the section on Galvanism, and a chapter is devoted to the method of determining it, and to the system of measurement of the current elements in electro-magnetic units. A historical sketch is given at the end of each section or chapter, in which the author and date of every important discovery or invention are noted.

A Perpetual Calendar. By John J. Bond, of the Public Record office. *(Bell and Daldy.)*—This work not only serves as an almanac for present and future years, but enables any one, having occasion to use it, to become acquainted with the old and new style of writing dates, and assigning correct days to dates according to the systems in various countries. In addition to the various uses for which it is suited it is well adapted for educational purposes, as there are many persons to whom the difference between the old and new styles is a mystery, and the date of the adoption of the latter wholly unknown.

Notes.

Industrial Prizes.—The Academy of Rheims has just issued its list of prizes for the years 1867, 8, and 9, one for each year; the first is a gold medal, of the value of 500 francs, for the best plan of construction of buildings, and arrangement of machinery and plant, for an establishment to combine wool-combing, spinning, and weaving. The second consists of a gold medal, of the value of 300 francs, for an exposition of the chemical composition of fire bricks generally employed in Rheims and its vicinity, and a comparative estimate of those and others. The third prize, a medal of the value of 500 francs, is offered for the best means of purifying the sewage of Rheims before it enters the river Vesle, and of applying the products to agricultural purposes; to be supported by practical proofs of the economy and facility of the means recommended.

Waterproofing.—The following plan of rendering tissues waterproof is said to be very effective:—Plunge the fabric into a solution containing 20 per cent. of soap, and afterwards into another solution containing the same percentage of sulphate of copper; wash the fabric, and the operation is finished. An indissoluble stearate, margarate or oleate of copper, is formed in the interstices of the tissue, which thus becomes impervious to moisture. This process is particularly recommended for rick cloths, awnings, and similar objects.

Discovery of Lithographic Stone in Paris.—In levelling the heights of the Trocadéro, for the new Place du Roi de Rome, a stratum of stone, as fine in grain as that used for hones, and from eight to twelve inches in thickness, has been laid open. A lithographer passing by the spot was struck with the resemblance of this stone to that used in his profession, and having obtained a piece, he caused it to be cut, polished, and dried in an oven; and having drawn a design upon it, succeeded in obtaining a number of excellent impressions of his drawings. It is said that this valuable discovery is likely to be turned to account.

Establishment for Nurses.—It is said that a very useful new Institution, an establishment for the supply of nurses, is about to be set on foot by the authorities of Paris; the object is to enable the public to procure at the office or offices, at any hour of the day or night, attendants accustomed to the sick room, and to all the

duties required in the case of accouchements, illness, or accident. Such an arrangement would certainly be a great boon to the inhabitants of a large city like Paris.

Microscopic Printing.—One of the objects that have excited the most curiosity in the recent exhibition at Toledo, was a complete edition of *Don Quixote*, printed in microscopic characters, on fifty-four cigarette papers, in four volumes.

The Italian Scientific Society, called The Forty.—There has existed in Italy for the last century a private foundation, quite independent of Government, the members of which, of the number of 40, are elected amongst themselves, never meet, but correspond by letter with the president. This society, which has its own funds, has published 50 large volumes of memoirs, containing the greatest works that have been produced in the departments of mathematics, physics, etc. The last president was the late M. Marianini, who is now succeeded by M. Matteucci, who was unanimously elected the 27th of last August. It is said to be the intention of this eminent philosopher to make this society become the great centre of publication of all progress of science made in Italy. After having obtained from the Minister of Public Instruction the foundation of two gold medals for the two best memoirs, published in the transactions of the society, M. Matteucci has founded, at his own expense, a third gold medal, to be given by the society to the author, in any country, of the most important discovery in natural philosophy of the year.

Moral Science Association.—On Monday the 8th instant, a conference was held in the Manchester Town-hall relative to a proposal to form a Moral Science Association. The Rev. Dr. Garrett presided, and the Rev. Dr. Cather described the intentions of the promoters of the proposed association. As there was a British Association for the Advancement of Science, and a National Association for the Promotion of Social Science, so let there be instituted an "Imperial Association for the Cultivation of Moral Science;" understanding by moral science all that was essential and practical in religion; and let this association hold an annual meeting. After an animated debate it was resolved that there was great need for the formation of a moral science association, and that it was most desirable that a Congress should be held as soon as practicable. The committee was then elected, and the procedings terminated

Proposed Maritime League in Italy.—There exist in Italy three great maritime companies—the Florio, for communication with Naples and Sicily; the Peirano, for postal service round Italy; and the Eastern Adriatic, for the service from Brindisi to Alexandria (Egypt). Now that Venice has become a part of the kingdom of Italy, it becomes necessary to connect it with these companies, and an opinion prevails that the only way to do so is to link it with the East by the creation of an establishment to rival the Austrian Lloyd's at Trieste. The wish therefore is to make Venice, in respect to this last, the head of a maritime league, and the Italian Government is said to desire this result. The Chamber of Commerce of Venice has already spontaneously occupied itself with the question, and sent delegates to Florence. The organisation in that port of an Italian Lloyd's is not considered of difficult realisation. People go from Alexandria to Brindisi, and the object now is to secure conveyance from the latter place to Venice. It appears that the Company which now works the service from Alexandria to Brindisi is ready to carry it on to Venice on the day that the king shall make his entry there, and that they offer to organise an immediate and uninterrupted service between that port and Egypt.

Packing in India Rubber.—France exports yearly more than a hundred million cases of fine wines, brandies, or liqueurs; and bottles, packed up to the present time in canvas, straw, or hay, cause a great deal of inconvenience and loss, both of time and money. For one house only, such as the Maison Hennessy, of Cognac, who alone export millions of bottles, this loss of time and money is estimated at about 100,000 francs. It occurred to a M. Becker, of Bordeaux, that india-rubber being incapable of transmitting vibration, small rings of it placed around bottles might be advantageously employed to keep them apart, from jarring, and, consequently, from breakage. It has been tried, and is said to have succeeded admirably. Many commercial houses of the Gironde, of Charente, and of Champagne have availed themselves of his process. The rings of india-rubber, after unpacking, are put aside, and are again ready for use, whilst the hay or straw, commonly used for packing purposes, would be thrown away.

Russo-American Telegraph.—Nearly the whole of the surveys on land and the soundings in Behrings Straits are completed. The following works will be completed this year, distributed amongst several sections. The line of telegraph will be lengthened 800 miles beyond the Port of Granley to Kvitchpok, and further in the valley of the Anadyr from its mouth to the Island of Anadyrik, from Okhotsk to Guijigùmik, and, perhaps, to the junction with the Anadyr section. The cables that are to be laid between the Bays of Grantly and Jeniaum (184 miles) and the Capes of Sponty and Solstoï are to be shipped in the course of the present month.

Various Trades of Paris.—At the present time there are in Paris 15 makers of reeds for clarionets, bassoons, and hautboys, 12 workers in horn, 18 gut workers, 4 makers of crutches, 10 drum-case makers, 12 sugar-plum makers, 13 firemen's helmet and axe manufacturers, 9 foot-warmer manufacturers, 30 wholesale silk-twist dealers, 19 dealers in hair, 15 muzzle-makers, 22 watchguard makers, 49 dressers of hare skins for hat-making, 9 breeches makers, 3 damask workers, 1 breaker-up of carriages, 6 embalmers, 5 incense makers, 8 curry-comb makers, 3 harp makers, 3 makers of snuffers, 16 coffee mill makers, 18 wholesale dealers in mustard, 4 stone polishers, 3 almond cake makers, 10 metal eye-hole makers, 23 ginger-bread makers, 7 lightning-conductor makers, 2 skate makers, 16 dealers in rabbit skins, 40 corn-cutters, 5 wafer-cake makers, 7 speaking-trumpet makers, 3 bee-hive makers, 2 dealers in bullocks' blood for refineries, 13 dealers in leeches, 8 makers of wooden blocks for hair dressers and milliners, 3 corkscrew makers, 16 dealers in vanilla, 8 pastrycook's jacket makers, and 12 artificial eye makers.

Paris Exhibition.—The principal industrial establishments in Italy are now actively preparing themselves for the great competition at the Universal Exhibition of 1867. At Florence several tables (unique in their kind) are being made. One is an oval-shaped table, representing in the centre the attributes of Bacchus, with a border of flowers, admirably executed; the parchment of a tambourine in Siberian jasper, the hoop of the instument in petrified wood, the bells in Volterra jasper imitating the reflexion of the copper; a wand of Bacchus, likewise in petrified wood, the pores and the knots of which may be readily distinguished; bunches of grapes in Oriental alabaster, of a delicious pearly transparency, the vine leaves in Sicilian jasper, with the warm and red tones of autumn upon them, birds with wings half open, flowers scattered about here and there, variegated camelias, blue bells in lapis-lazuli twined around the branches, the fine grain of the stones giving them a freshness, a brilliancy, and life-like appearance.

Correspondence.

Paris Exhibition of 1867.—Sir,—In reference to your invitation, contained in the *Journal* of the 28th of September, page 700, I beg to say a few words relative to the new prizes offered to the competition of the world by the Imperial Commission. The terms of the announcement are undoubtedly vague, but I do not think it at all difficult to comprehend from them what the intention is.

The words used are—"Un ordre distinct de récompenses est crée en favour des personnes, des établissements ou des localités qui, par une organization ou des institutions spéciales, ont développé la bonne harmonie entre tous ceux qui coopèrent aux mêmes travaux et ont assuré aux ouvriers le bien-être matériel, moral, et intellectuel." Now the translation of this passage, as given in the letter of "A Puzzled Reader" to the *Times*, contains one word more than is in the original, and this surplusage adds somewhat to the obscurity complained of; the phrase, "by a special organization or special institutions," should, I think, have been "by organization or special institutions"—that is to say, either by the reorganization of an old establishment or the setting up of a new one, the word institution not having exactly the same value in the two languages. With this alteration the prize, then, may be given either to the originator, organizer, or manager of an establishment. This point cleared up, I come to another—that of co-operation; here again I think the meaning has been slightly perverted; the French phrase does not necessarily include any idea of a co-operative establishment, but merely refers to the harmony produced amongst all parties engaged in the work, whatever that may be—harmony amongst employers, directors, and workmen. It seems to me, then, that the intention is tolerably clear, and that the prizes are offered to those who have been the agents in producing the largest amount of harmony, combined with the material, moral, and intellectual well-being of the workmen employed in any industrial establishment, for the word *ouvrier* clearly excludes any institution not industrial. It seems to me therefore that "hospitals, clubs, museums," or colleges would not come within the conditions named, and that the prizes are intended to be given to those who have done most for the material, moral, and intellectual well-being of all employed in productive establishments. The great prize seems therefore intended for the founder, organizer, or reorganizer of that industrial establishment which presents the most remarkable arrangements for the comfort, morality, and educational improvement of all engaged therein. It is rather invidious to name any one establishment, but it seems to me that Mr. Titus Salt's working town of Saltaire, "with its complete sanitary arrangements, its schools, chapels, clubs, halls, and perfect factory organization," exactly fulfils all the conditions laid down by the Imperial Commission; and I may add that I believe England can produce its fair share of worthy candidates for the minor prizes in question. It must not be forgotten, however, that of late years our neighbours have done much, not only in the organization of industrial establishments, but also for the material, moral, and intellectual well-being of the working classes, and that the competition will be all the more honourable from the fact that we shall have to compete with worthy and redoubtable rivals.—I am, &c., G. W. Yapp.

Patents.

From Commissioners of Patents' Journal, October 5th.

Grants of Provisional Protection.

Ammonia, &c., making—2362—G. Robinson.
Bath, combined with travelling trunk, and self-rocking cradle—2391—W. H. Bailey.
Bottles—2399—A. S. Stocker.
Bottles, &c., closing—2361—J. J. Baranowski.
Boxes or cases—2370—R. Couchman.
Braiding machines and warp regulators—2369—W. Tunstill.
Bricks—2386—J. H. Johnson.
Buildings, heating—2396—H. J. Newcome.
Fibrous materials, cleansing—2352—J. L. Norton.
Fibrous materials, spinning—2382—J. Dunn.
Fibrous matters, preparing—2375—C. C. Connor.
Fibrous substances, cleaning, &c.—1906—E. Leigh, H. T. Palmer, and W. H. Whitehead.
Fibrous substances, treating—2269—E. Nelson.
File blanks, grinding—2385—J. Dodge.
Fish hooks—2368—J. Bindley.
Grain from straw, separating—2394—W. E. Gedge.
Grain, separating, &c.—2177—J. T. Poyser.
Horse hay rakes—2358—R. R. Riches and C. J. Watts.
Iron—2374—B. Bayliss.
Iron, smelting—2390—G. Dyson.
Kites—2099—J. W. Hoffman and G. R. Wilson.
Latitude and longitude, obtaining—2363—C. F. Varley.
Letter boxes and pillars—2404—W. Dennis.
Life at sea, saving—1514—H. W. Hire and J. White.
Metallic pistons—2366—A. Oldham.
Metals, planing—2406—E. Barlow and W. N. Dack.
Metal spring cases for cigars, &c.—2359—G. H. Cheshire.
Oil from shale, making—2380—P. Brash and W. Young.
Pneumatic steam dredging machines—2407—W. E. Gedge.
Printing machines—2403—H. S. Cropper.
Pulley blocks—2398—H. W. Ley.
Purses, &c., clips or fastenings for the bands of—2373—T. Newby.
Railways—2384—W. E. Gedge.
Railway trains, communication between the guard and passengers in—2097—J. W. Hoffman and G. R. Wilson.
Sausage-making and mincing machine—2402—G. Keene.
Screw nuts, turning—2392—J. Thompson.
Ships' anchors—2356—J. H. Betteley.
Ships' anchors—2379—J. Jackson.
Shipwreck, saving life in cases of—2123—W. E. Newton.
Show cases—2401—F. Sage.
Soluble alkaline silicates—1859—L. Mignot.
Steam boilers—2378—J. Twibill.
Steam boilers—2408—T. Dixon.
Steam boilers, cleaning the tubes of—2287—D. McDowell.
Steam engines—2405—E. Barlow and W. N. Dack.
Substances, cutting frets in—2365—J. H. Johnson.
Substances, cutting, &c.—2364—C. P. Stewart and H. Chapman.
Substances, drying, &c.—2376—W. Creasy.
Textile fabrics, cutting—2350—E. Phillips and J. Howie.
Travelling bags—2354—R. Robinson.
Tube cutters—2395—T. Parkes.
Valves—2248—H. G. Scott and N. Hallowell.
Violins, &c.—2071—H. Bell.
Water tuyeres—2372—N. Dunn.
Whips, &c.—2371—J. Keyston.
Winding apparatus—2367—J. Boyd, J. McPherson, T. K. Kerr, and J. Taylor.
Wire, straining—2397—J. H. Sams.
Wood, preserving—2245—A. de la Gautraye.

Inventions with Complete Specifications Filed.

Bronzing machines—2484—G. Haseltine.
Files, cutting—2490—A. F. Johnson and M. P. Griffin.
Water, raising—2483—H. A. Bonneville.

Patents Sealed.

955. G. P. Wheeler.
956. F. Wise.
957. P. J. Macaigne.
958. A. A. Hely and J. Marshall.
959. W. Betts.
960. J. H. Johnson.
962. W. Howitt.
969. F. Rebière.
970. G. Allix.
974. S. Richards.
977. B. Johnson.
981. F. E. Walker.
982. W. H. Phillips.
983. J. H. Johnson.
997. E. T. Hughes.
1000. W. Clissold.
1004. J. L. Davies.
1006. R. W. Thomson.
1033. J. Crofts.
1035. W. Clark.
1044. H. B. James.
1057. C. H. Murray & M. Jennings.
1061. H. A. Bonneville.
1472. H. A. Bonneville.
1683. T. S. Hudson.

From Commissioners of Patents' Journal, October 9th.

Patents Sealed.

1009. B. F. Weatherdon.
1012. I. M. and S. MacGeorge.
1015. S. J. Sherman.
1018. T. P. Tregaskis.
1019. R. Leake, W. Shields, and J. Beckett.
1023. J. Sparrow and S. Poole.
1028. J. Frost.
1029. W. Young.
1030. W. Wishart.
1032. J., J., and J. Crabtree.
1048. W. Clark.
1072. J. Hayes, sen., and J. and J. Hayes, jun.
1090. J. Marshall.
1099. E. Tuttle.
1100. G. Beadon.
1186. M. Nelson.
1215. G. Davies.
1233. G. C. Denis.
1234. J. Jackson.
1241. J. and G. Shorrock.
1287. J. L. Booth.
1333. W. E. Newton.
1361. T. Hunt.
1372. W. Gerard.
1379. G. Haseltine.
1381. W. de la Rue and H. Muller.
1383. H. Muller and W. de la Rue.
1404. W. E. Newton.
1539. A. B. Brown.
1563. P. Righetti.
1860. E. Drucker.
1999. H. J. Batchelder.
2112. A. L. Wood.

Patents on which the Stamp Duty of £50 has been Paid.

2444. R. A. Brooman.
2491. T. Hughes.
2438. J. Towlson.

Patent on which the Stamp Duty of £100 has been Paid.

2235. E. Morewood.
2286. W. Brookes.
2274. E. O'Connell.
2291. W. Irlam.
2313. A. Whytock.
2277. W. Macfarlane.